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What is claimed is:

1. A method of detail enhancement for an original
image signal represented by a set of pixels, comprising the
5 steps of:

(a) detecting image pixels that belong to an image
edge;

(b) generating gain suppression factors for the
detected pixels; and

10 (c) performing image detail enhancement on the image
pixels while selectively reducing enhancement of the
detected image pixels relative to enhancement of other
image pixels based on the gain suppression factors.

15 2. The method of claim 1, further comprising the
steps of:

selecting enhancement gain factors for the image
pixels; and

combining the gain suppression factors with the
20 corresponding enhancement gain factors to obtain adjusted
gain factors;

wherein the steps of performing image detail
enhancement further includes the steps of performing image
detail enhancement on the image pixels based on the

adjusted gain factors to selectively reduce enhancement of the detected image pixels.

3. The method of claim 2, wherein the step of
5 detecting pixels further includes the steps of:

detecting the center pixel location and the length of the luminance transition range of the edge.

4. The method of claim 3, wherein the step of
10 generating a gain suppression factor for a detected pixel further includes the steps of:

for each pixel within the detected luminance transition range, generating a gain suppression factor based on: (i) the position of the pixel within the
15 luminance transition range, (ii) the enhancement gain factor for that pixel, and (iii) the luminance contrast across the edge.

5. The method of claim 3, wherein:
20 the step of generating the gain suppression factors further includes the steps of selecting the gain suppression factors such that detail enhancement at the center pixel location in the luminance transition range is suppressed more than neighboring pixels in the luminance

transition range, wherein for pixel locations farther away from the center pixel location detail enhancement suppression is further reduced.

5 6. The method of claim 5, wherein the gain suppression factors are selected to essentially eliminate detail enhancement suppression for pixels outside the detected luminance transition range.

10 7. The method of claim 3, wherein the step of generating the gain suppression factors further includes the steps of:

selecting a candidate gain suppression factor α_c for each pixel location within the detected luminance

15 transition range as:

$$\alpha_c = |i| * (1-s) * 2 / (N+1) + s$$

where:

N is the length of the luminance transition range,

20 *i* is the index for the location of a pixel p_i in the luminance transition range, $-\frac{N-1}{2} \leq i \leq \frac{N-1}{2}$, such that the index of the current pixel location is 0, and

s is a variable related to both the local luminance contrast and the pixel's enhancement gain factor, $0 \leq s \leq 1$.

5 8. The method of claim 7, wherein:

$$s = 1 - \max(0, \min(1, (d - T_1)/(T_2 - T_1)))$$

where:

T_1 and T_2 are predetermined threshold values, $T_2 > T_1 \geq 0$, and

10 d is the luminance contrast within the detected luminance transition range, as:

$$d = |p_{\frac{N-1}{2}} - p_{\frac{N-1}{2}}|.$$

9. The method of claim 8, wherein the threshold values T_1 and T_2 are related to an enhancement gain factor
15 K , as:

$$T_1 = C_1 / K,$$

$$T_2 = C_2 / K$$

where C_1 and C_2 are constants.

20 10. The method of claim 7, wherein the steps of generating the gain suppression factor for a detected pixel

further includes the steps of:

selecting an initial gain suppression factor α ;

upon generating each candidate suppression factor

α_c for the pixel location, updating α as:

5
$$\alpha = \min(\alpha, \alpha_c) .$$

11. The method of claim 2, wherein the step of performing detail enhancement for the original image signal

10 f at a detected pixel further includes the steps of:

performing a low pass filter function on the image signal f to generate an unsharp image signal f_1 ;

determining the difference between the original image signal f and the unsharp signal f_1 , wherein said

15 difference represents image details;

selectively boosting the difference signal such that enhancement of the difference signal at the detected pixel locations is reduced relative to enhancement of other image pixels based on the gain suppression factors; and

20 adding the boosted signal to the original signal to obtain a detail enhanced image signal g .

12. The method of claim 11, wherein the enhanced image signal g is related to the original image signal f as:

$$g = (f - f_1) * K * \alpha + f$$

5 wherein:

$(f - f_1)$ is the difference signal,

K is the enhancement gain factor for the pixel, and

α is the gain suppression factor for the
10 pixel.

13. The method of claim 1 wherein the step of detecting image pixels that belong to an image edge, further includes the steps of detecting image pixels that
15 belong to a slant image edge.

14. The method of claim 1, wherein the step of detecting image pixels that belong to an image edge further includes the steps of:

20 defining a two-dimensional window of pixels in the digital image;

 determining a variance value for a plurality of pixels around a selected pixel inside said window;

 based on the variance value, determining if the

selected pixel is in an edge region in the window;

if the selected pixel is in an edge region, then determining if the selected pixel is essentially a center pixel in a luminance transition range of a slant edge; and

5 if the selected pixel is essentially a center pixel in a luminance transition range of a slant edge, then determining the length of the luminance transition range of the slant edge.

10 15. A detail enhancement system for enhancing an original image signal represented by a set of pixels, comprising:

(a) a detector that detects image pixels that belong to an image edge;

15 (b) a generator that generates gain suppression factors for the detected pixels; and

(c) a detail enhancer that performs image detail enhancement on the image pixels while selectively reducing enhancement of the detected image pixels relative to
20 enhancement of other image pixels based on the gain suppression factors.

16. The system of claim 15, wherein the detail enhancer combines the gain suppression factors with

selected enhancement gain factor to obtain adjusted gain factors, and performs image detail enhancement on the image pixels based on the adjusted gain factors to selectively reduce enhancement of the detected image pixels.

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17. The system of claim 16, wherein the detector detects the center pixel location and the length of the luminance transition range of the edge.

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18. The system of claim 17, wherein the generator generates a gain suppression factor for a pixel within the detected luminance transition range based on: (i) the position of the pixel within the luminance transition range, (ii) the enhancement gain factor for that pixel, and

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(iii) the luminance contrast across the edge.

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19. The system of claim 16, wherein the generator selects the gain suppression factors such that detail enhancement at the center pixel location in the luminance transition range is suppressed more than neighboring pixels in the luminance transition range, wherein for pixel locations farther away from the center pixel location detail enhancement suppression is further reduced.

20. The system of claim 19, wherein the gain suppression factors are selected to essentially eliminate detail enhancement suppression for pixels outside the detected luminance transition range.

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21. The system of claim 17, wherein the generator generates the gain suppression factors by selecting a candidate gain suppression factor α_c for each pixel location within the detected luminance transition range as:

$$10 \quad \alpha_c = |i| * (1-s) * 2 / (N+1) + s$$

where:

N is the length of the luminance transition range,

i is the index for the location of a pixel

$$15 \quad p_i \text{ in the luminance transition range, } -\frac{N-1}{2} \leq i \leq \frac{N-1}{2}, \text{ such}$$

that the index of the current pixel location is 0, and

s is a variable related to both the local luminance contrast and the pixel's enhancement gain factor, $0 \leq s \leq 1$.

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22. The system of claim 21, wherein:

$$s = 1 - \max(0, \min(1, (d - T_1) / (T_2 - T_1)))$$

where:

T_1 and T_2 are predetermined threshold values, $T_2 > T_1 \geq 0$, and

d is the luminance contrast within the
5 detected luminance transition range, as:

$$d = |p_{\frac{N-1}{2}} - p_{\frac{N-1}{2}}|.$$

23. The system of claim 22, wherein the threshold
values T_1 and T_2 are related to an enhancement gain factor
10 K , as:

$$T_1 = C_1 / K,$$

$$T_2 = C_2 / K$$

where C_1 and C_2 are constants.

15 24. The system of claim 21, wherein the generator
generates the gain suppression factor for a detected pixel
by selecting an initial gain suppression factor α , and
upon generating each candidate suppression factor α_c for the
pixel location, updating α as $\alpha = \min(\alpha, \alpha_c)$.

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25. The system of claim 16, wherein the detail enhancer performs detail enhancement for the original image signal f at a detected pixel, the detail enhancer comprising:

5 a filter that performs a low pass filter function on the image signal f to generate an unsharp image signal f_1 ;

a difference node that determines the difference between the original image signal f and the unsharp signal f_1 , wherein said difference represents image details;

10 a combiner that selectively boosts the difference signal based on the gain suppression factors such that enhancement of the difference signal at the detected pixel locations is reduced relative to enhancement of other image pixels; and

15 a summing node that combines the boosted signal to the original signal to obtain a detail enhanced image signal g .

20 26. The system of claim 25, wherein the enhanced image signal g is related to the original image signal f as:

$$g = (f - f_1) * K * \alpha + f$$

wherein:

$(f - f_1)$ is the difference signal,

K is the enhancement gain factor for the pixel, and

5 α is the gain suppression factor for the pixel.

27. The system of claim 15, wherein to detect image pixels that belong to an image edge the detector defines a
10 two-dimensional window of pixels in the digital image, determines a variance value for a plurality of pixels around a selected pixel inside said window, based on the variance value, determines if the selected pixel is in a an edge region in the window, if the selected pixel is in an
15 edge region, then the detector determines if the selected pixel is essentially a center pixel in a luminance transition range of a slant edge, and if the selected pixel is essentially a center pixel in a luminance transition range of a slant edge, then the detector determines the
20 length of the luminance transition range of the slant edge.